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Differences in Fertility in Highlander and Lowlander Bods of Himachal Pradesh

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ABSTRACT Demographic data were collected from 153 Bod families living in high altitude (3200 m approx.) Gahar Valley and 225 Bod families living in low altitude (1000-1400 m) Kullu Valley. Analysis of fertility data reveal marginally higher fertility in high altitude sample than in ethnically similar lowlander Bods. The altitudinal differences in fertility have been explained in terms of socio-cultural factors such as education, awareness, urban contact, advancement in medical facilities, which are better at low altitude. The differences have also been accorded to a stronger feeling at high altitude that children are economic assets. Age specific fertility rates do not show wide difference with altitude except that the population growth continues at high altitude even in later age groups, specially between 35-45 years culminating in their overall higher fertility.

An appropriate reproductive performance is one of the prime requirements and indicators of environmental adaptation. With this perspective, a number of studies have been conducted on fertility in high altitude populations, but with equivocal results. In many of these studies the limitation has been the non availibility of a suitable control in terms of an ethnically similar lowland poulation. Therefore the present study has been conducted on highlander Bods of Gahar valley, Lahul-Spiti and ethnically similar lowlander Bods of Kullu valley. The investigation has the following aims:

(1) To study altitudinal differences in crude birth rate, general fertility rate, net reproduction rate, gross reproduction rate, total fertility rate, completed family size, mean number of children/woman and child woman ratio.
(2) To examine altitudinal difference in age specific fertility rates.

MATERIAL AND METHODS

The Samples

Demographic data were collected, using questionnaire method, from Bods—a Scheduled Tribe of Himachal Pradesh. The high altitude sample included 153 Bod families living in Gahar Valley (Lahul). The low altitude sample comprised 225 Bod families dwelling in Kullu Valley. Bods, at both the places, are endogamous and follow clan exogamy. Gahar Bods, as also the Kullu Bods, prefer to marry among themselves, though there is no restriction to marry with each other. Limited communication between the two places and series of rituals associated with marriage and those follow thereafter make intermarriage a rare possibility.

Field work was conducted from October to December, 1986 in Gahar Valley and from August to October, 1987 in Kullu Valley. The recommendations of Human Adapatability Panel of International Biological Programme were followed for data collection (Weiner and Lourie, 1969; Baker and Dutt, 1972). In addition, questions related to socio-cultural, economic and other aspects were also asked. Door to door survey was conducted interviewing 'fully married' woman and her husband who acted as the primary informants. The informations were cross-checked from atleast one elderly and one young member of the household. As such four persons were interviewed from a household.

Fertility Measures

Following fertility measures were taken into

consideration:

(1) Crude Birth Rate (C.B.R.),
(2) General Fertility Rate (G.F.R.),
(3) Gross Reproduction Rate (G.R.R.),
(4) Net Reproduction Rate (N.R.R.),
(5) Age Specific Fertility Rate (A.S.F.R.),
(6) Total Fertility Rate (T.F.R.),
(7) Completed Family Size (C.F.S.) or Completed Fertility Rate (C.F.R.),
(8) Mean Number of Children/Woman,
(9) Child-Woman Ratio.

RESULTS AND DISCUSSION

The ability of a population to adapt to its environment depends on its fertility and population growth. A simple child woman ratio has often been used for assessing fertility of a population. In high altitude Bods, the child-woman ratio is higher (38.69) than low altitude Bods (33.06), indicating higher fertility in high altitude Bods. In some of the earlier researches, a lower child-woman ratio has been reported in high altitude natives (Stycos, 1963, 1965; Heer, 1964, 1967; Heer and Turner, 1965; Baker and Dutt, 1972; Dutt, 1976; Basu and Mukhopadhyay, 1980). It is noteworthy that the child-woman ratio is not an accurate measure of fertility in populations where infant and early childhood mortality is high (Whitehead, 1968; Bradshaw, 1969; Baker, 1972; Dutt, 1976). Therefore, a number of other fertility measuers have been calculated. In Bods, crude birth rate, general fertility rate, net reproduction rate, total fertility rate, sum of age specific fertility rate, completed family size and mean number of children per woman are higher at the high altitude than at the low altitude (Table 1).

An inspection of literature on fertility at high altitude reveals two distinct trends. First, that fertility remains either uninfluenced or is only marginally affected at higher altitude. Second, fertility differences do exist in high and low altitude populations. It is also not always true that the low altitude populations, as compared to high altitude populations, have lower fertility. At least some studies have observations on the contrary.

Table 1: Altitudinal differences in fertility measures in Bods

Fertility Measures	*High Altitude*	*Low Altitude*
Crude Birth Rate	42.76	35.66
General Fertility Rate	141.69	114.28
Net Reproduction Rate	2.31	2.01
Gross Reproduction Rate	2.76	2.23
Total Fertility Rate	5.51	4.49
Completed Family Size	6.27	4.92
Mean Number of Children/ Woman	4.11	3.63
Child Woman Ratio	38.69	33.06

Even lower fertility at low altitude, compared to high altitude, has not been explained on the same reasons. In fact the viewpoints have been dichotomous. Few strongly believe that low oxygen pressure at high altitude reduces fertility, whereas others argue that improved socio-economic and medical facilities at low altitude are responsible for causing altitudinal differences in fertility. The differences in opinion have, however, recently been minimised as the followers of both the thoughts have started admitting the role of other factors though they keep emphasising the factors they initially stated to be responsible for causing the difference. At this juncture, it should be noted that the degree, kind and amount of high altitude stress can also cause variation in altitudinal difference in the fertility pattern. Viewpoints of different authors on fertility at high altitude are briefly discussed here.

A number of earlier studies have observed that the low oxygen pressure does not influence fertility. For example, Monge (1948) observed that the Spanish migrants to the Andean high altitude were quite fertile in terms of conception but the incidence of pre-natal and neo-natal mortality was extremely high. Similarly, Sobrevilla (1968) on the basis of census data from Peru concluded that population growth varied little with altitude. In Bolivia, Dutt (1976) did not find significant difference in the mean number of live births or total pregnancies with altitude. Similarly, in a study from U.S.S.R., Mirrakhimov (1978) reported a low number of births and small alti-

tudinal difference (5.0 at high altitude and 5.4 at low altitude). Goldstein and his co-workers (1983) revealed that in Ladakhis, completed fertility rate was 6.6 for fully married women and 6.1 for all women. They summarised that all the high altitude Himalayan populations, for which the data then existed, exhibited moderately high fertility and these fertility levels did not differ significantly from the low altitude populations. Goldstein and his associates (1983) showed that in Andean populations, there is no significant correlation between altitude and fertility and the fertility differences between high, middle and low altitude populations are non-significant.

Some of the previous investigators have observed higher fertility at high altitude. For example, Cruz-Coke and his associates (Cruz-(1966) found an unusually high birth rate (82.4/1000) in a small group of high altitude Aymara in Chile. This was further supported by Cruz-Coke (1968) who observed that total fertility in high altitude was greater than at low altitude. Similarly, completed fertility rate of (7.6 children/woman) from central Peru (C.I.S.M., 1968) was higher than that of Nunoan completed fertility rate of 6.7 children/woman (Hoff, 1968; Baker, 1969; Hoff and Abelson; 1976). These fertility rates are quite high as compared to the modern standards. Clegg and his co-workers (1970) suggested that the loss of individuals before the reproductive age in the Ethiopian highlands is buffered by high fertility making them capable of maintaining their number. Baker (1978) observed that high altitude people of the world have more than adequate fertility for the reproductive needs and indeed people in Andes and parts of Nepal are producing a rapidly growing populations. Bouli and Goldstein (1981) reported a completed fertility rate as 7.4 for Limi in North-West Nepal. Similarly, Goldstein and his co-workers (1983) found higher fertility rate among Kyilung Buddhist and Moslems in Ladakh. In Limi population (N.W.Nepal), Goldstein (1981 a,b) observed astonishingly high completed fertility rate of 7.4 for married females, which is the highest ever reported from any high altitude Himalayan population. He suggested that polyandry practice, presence of celebate nuns, etc. are more important in determining fertility, as compared to the environmental factors.

In high altitude Bods from Lahul, fertility is higher than that of ethnically similar lowlanders. Minor fertility differences in the two groups can be explained on the basis of marginal difference in some of the socio-cultural factors such as education, awareness, urban contact, technological advancement, medical facilities. Another factor responsble for higher fertility in high altitude Bods may be that in this community children are considered to be economic assets; this feeling is much stronger at high altitude. This is in agreement with the view that in communities where children are considered to be economic assets, fertility is higher (Thomas, 1972; Weitz et al., 1978; Basu and Mukhopadhyay 1980; Goldstein, 1981 a,b; Goldstien et al., 1983; Basu et al., 1984).

A series of studies are not in agreement that there is no altitudinal impact on fertility or high altitude populations have relativcly higher fertility. For example, in the Eastern Himalayas, particularly Nepal, the low altitude populations have been observed to be more fertile (Lang and Lang, 1971; Goldstein, 1976; Weitz et al., 1978; Gupta, 1978; Basu et al., 1979; Gupta, 1980 ; Basu and Mukhopadhyay, 1980; Bangham and Sacherer, 1980; Weitz, 1981 a; Gupta et al., 1987). Some studies conducted in Andes (Cruz-Coke et al., 1966; Donayre, 1966; Hoff, 1968; Way, 1972; Abelson, 1972, 1976, 1984a, b; Baker and Dutt, 1972; Abelson et al., 1974; Hoff and Abelson, 1976; 1981, 1976; Clegg, 1978; Dutt, 1980; Weitz, 1981 b; Bangham, 1984; Hoff, 1984) propounded that hypoxia is a major stress at high altitude responsible for reducing fertility. It has also been augmented that hypoxia inhibits gametogenesis, gametic survival, successful implantation of the fertilized ovum (Pawson, 1974; Way,1976; Clegg, 1978) and reproductive hormones (Bangham and Hacket, 1978). All these factors individually or collec-

tively depress fertility. Weitz (1981 a) suggested that the difference between Khumbu Sherpas and the moderate altitude Solu, Arun, Helambu and Kagate Sherpas fertility may be explained by factors other than hypoxia, such as husband absenteeism and hypothyroidism. In contrast, Abelson (1984 a,b) observed that the removal of hypoxic stress did result in an increase in fertility. Goldstein and his associates (1983) stressed that the low completed fertility rate among the Sherpas of Nepal is not caused by hypoxia induced low fertility but is a product of cultural factors affecting the exposure of females to the risk of pregnancy. Earlier investigators (Weitz et al., 1978; Gupta, 1978, 1980; Bangham and Sacherer, 1980; Weitz, 1981 b) have, however, argued that in Nepal fertility increases at low altitude because of improved socio-economic conditions, and better medical facilities. Thus, the altitudinal differences in fertility depend on degree, kind and amount of environmental streeses on one hand and differences in socio-cultural factors, including medical facilities, on the other.

Considering that no contraceptives were used by Bods at high altitude even a decade ago and they concurrently considered children to be economic assets, the reported fertility at high altitude is rather low, though it is higher than at low altitude. This, not so high fertility, can be accorded to the taboos related to sexual intercourse. Same trend of not so high fertility continues even today because of certain social practices, such as ceremonial, menstrual and post-partum abstinence, joint wool weaving by females during winter nights, separate male parties in which females can not participate, lactational amenorrhea and other socially determined factors that limit sexual contact. For example, for nearly four to six months after marriage, wife is not suppose to come in contact with her husband. Similarly the period of post-partum abstinence varies from nine months to one and a half year. The Bod females take pride and remain lactating the young ones for nearly two to two and a half years, or sometimes even upto the birth of the next child. Fertility is affected by both socio-cultural and environmental factors, though it is difficult to isolate the role of these factors.

Analysis of age specific fertility rates has provided the following informations (Table 2). Firstly, fertility is minimum during 15-19 yrs. in high altitude Bods, whereas it is so during 45+ yrs. in low altitude Bods. Secondly, fertility is maximum during 25-29 yrs. in high altitude Bods, whereas it is so during 20-24 yrs. in low altitude Bods. Thirdly, in high altitude Bods, fertility increases upto 25-29 yrs. and thereafter it decreases steadily, but fertility during 45+ yrs., is greater than at 15-19 yrs. None the less, in low altitude Bods fertility increases upto 20-24 yrs., thereafter it decreases gradually upto 45+ yrs. Fourthly, in all the age sets except 20-24 yrs., fertility is comparatively higher in high altitude Bods than low altitude Bods. The results indicate that both the groups make full use of their reproductive period though high altitude Bods continue to do so for a longer period resulting in higher fertility. On the other hand, it appears that the migrant Bods to low altitude have retained the fertility characteristics of its parent high altitude population. Dutt (1976 a) forwarded a hypothesis that low altitude women tend to have more pregnancies in their teens and the high altitude women have more in their late 30s and 40s. This is not applicable to Bods, as fertility is maximum during 20 to 39 yrs. in high altitude Bods and 20 to 34 yrs. in low altitude Bods. After 15

Table 2: Altitudinal differences in Age Specific Fertility Rate

Mother's Age Groups (Years)	*Fertility*	
	High Altitude	*Low Altitude*
15-19	40.89	37.91
20-24	228.70	231.58
25-29	242.36	210.00
30-34	233.33	201.77
35-39	173.11	136.26
40-44	119.10	53.33
45+	64.94	26.23
Total	1102.43	897.08

to 19 yrs., fertility in high altitude Bod mothers remain more or less the same throughout their reproductive period. And in all the age groups, the highlanders have higher fertility than the lowlanders, the differences are, however, statistically non-significant (Table 2). Previous investigators (Cruz-Coke, 1968; Neel, 1968) also observed higher fertility throughout the reproductive period at high altitude than at low altitude. They also observed that in the low altitude women, the probability of becoming pregnant is the highest during first few years after marriage and thereafter it falls rather steeply. However, low altitude Bods seem to have retained the ancestral population characteristic by not showing a sharp decline in fertility.

It may be concluded that except for minor variations, both the groups have overall similarity in their age specific fertility rates. The reasons may be their genetical as well as socio-cultural similarities. Since the migrants retain the fertility characteristics of their parent population (Goldberg, 1959; Iutaka et al., 1971), the similarities between two Bod groups are natural.

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